ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 06, 2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

Improving Product Quality through the Control of Technological Parameters of the Saw Ginning Machine

Authors:

Berdaliyeva Mohlaroyim Abdulhamid qizi

PhD Student, Namangan Institute of Engineering and Technology

Sarimsakov Olimjon Sharipjanovich

Doctor of Technical Sciences, Professor, Namangan Institute of Engineering and Technology

Abstract:

This study identifies the relationship between the rotational speed variations of a newly profiled saw and saw cylinder with the machine's performance, seed damage, and fiber quality (impurity accumulation). The research was conducted on a DP-30 laboratory stand using cotton samples of the "Yoleta" and "R3" varieties. The input parameters considered were the saw tooth height, pitch, and rotational speed. Output parameters included fiber productivity, seed damage, and fiber impurity indicators. The study found that productivity increased with greater tooth size and rotational speed, while seed damage remained relatively stable.

Keywords: saw gin, saw tooth, rotational speed, seed damage, fiber impurity, productivity, frequency converter

Introduction:

In recent years, scientific research has been conducted to improve the efficiency of fiber separation in mechanical cotton ginning processes by changing the geometric parameters of the saw (tooth height and pitch) and its rotation speed. Such studies aim to reduce seed damage, control fiber impurities, and optimize energy consumption. A detailed study of the technological aspects of fiber separation enables the improvement of machine design, introduction of new saw profiles, and the development of intelligent control systems. This thesis experimentally examines the impact of newly profiled saw teeth and changes in rotational speed on key indicators such as product quality (fiber impurity), production efficiency (productivity), and seed damage. The research was conducted on a DP-30 laboratory stand with cotton samples of the "Yoleta" and "R3" varieties. Based on the results, important conclusions were drawn to optimize machine parameters for improved product quality and production efficiency.

Research Methods and Objects:

Optimizing the parameters of saw ginning machines in the initial cotton processing stage is crucial for ensuring fiber quality and product yield. Studies based on newly profiled saws provide opportunities to develop effective technologies that meet current requirements. The main objectives of the conducted research were:

1. To determine the influence of new saw profile parameters and rotational speed.
2. To measure machine productivity, seed damage, and fiber impurity.
3. To select optimal tooth parameters and speed modes.

The experiment was conducted on a DP-30 laboratory stand using "Yoleta" and "R3" cotton varieties with the following input parameters:

- x_1 – tooth pitch: 2.35 mm and 2.97 mm
- x_2 – tooth height: 1.3 mm and 2.2 mm
- x_3 – rotation speed: 550 and 850 rpm

Output parameters:

- y_1 – productivity (kg/saw/hour)

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 06, 2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

• y_2 – seed damage (%)
• y_3 – fiber impurity (%)

Research Results:

1. With saw teeth height 1.3 mm and pitch 2.35 mm:
• n = 550 rpm: y_1 = 1.29; y_2 = 7.1%; y_3 = 3.05%
• n = 850 rpm: y_1 = 1.44; y_2 = 7.0%; y_3 = 3.15%

2. With saw teeth height 2.2 mm and pitch 2.97 mm:
• n = 550 rpm: y_1 = 2.36; y_2 = 7.03%; y_3 = 3.2%
• n = 850 rpm: y_1 = 2.93; y_2 = 7.01%; y_3 = 3.09%

Conclusion:

Changes in the geometric parameters of the saw teeth (height and pitch) significantly affect machine productivity, seed damage, and fiber impurity accumulation. Specifically, increasing the saw tooth height from 1.3 mm to 2.2 mm and pitch from 2.35 mm to 2.97 mm resulted in increased overall productivity from 1.29 kg/hour to 2.93 kg/hour. This volumetric growth is attributed to the expanded mechanical capability of the saw to grip and pull multiple fibers simultaneously. As the rotational speed increased (n = 550 → 850 rpm), the linear speed of the saw also increased (9 m/s → 14 m/s), positively impacting productivity by enabling more fiber to be separated in a given time. However, in some cases, a slight increase in impurity content was observed at higher speeds, suggesting that excessively high speeds may negatively affect the cleaning efficiency.

Seed damage indicators ranged from 6.8% to 7.3%, with no significant difference between speeds and tooth sizes, indicating stable operation of the saw gin when properly adjusted. Fiber impurity levels ranged from 3.05% to 3.28%, depending on saw tooth parameters and speed. This result indicates that high-toothed, high-speed saws may not fully ensure impurity separation, suggesting the need for additional cleaning stages.

Optimal parameters under experimental conditions:
• Saw tooth height – 2.2 mm
• Tooth pitch – 2.97 mm
• Rotational speed – 850 rpm
• Linear speed – 14 m/s

At these settings, the highest productivity (2.93 kg/hour) was achieved, with stable seed damage (7.01%) and acceptable impurity levels (3.09%).

Based on the experiment results, it is recommended to correctly select saw geometry and precisely control rotational speed using a frequency converter when improving machine design. This ensures energy efficiency, product quality, and a flexible technological process adapted to demand. This study also identified the potential for implementing intelligent control systems in saw ginning machines. For example, mechanisms could be introduced to automatically adjust speed based on fiber cleanliness using sensors.

REFERENCES:

1. Abdurahmonov T. “Cotton Cleaning Processes and Technology”. – Tashkent: Ilm Ziyo, 2020. – 230 pages.
2. Rustamov A.R. “Cotton Fiber Quality and Its Determination Methods”. – Tashkent: O‘qituvchi, 2018. – 180 pages.
3. Yang Y., Calhoun J., & Wanjura J. (2020). Influence of saw speed on ginning performance and fiber damage. // Journal of Cotton Science. – Vol. 24(3), pp. 312–319.
4. ASTM D5867-05: Standard Test Methods for Measurement of Physical Properties of Cotton Fibers. – ASTM International, 2015.
5. ISO 4911: Textiles – Cotton fibres – Determination of impurity content. – ISO, Geneva, 2016.

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 06, 2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

6. Sarimsakov O.Sh., Aliyev A.M. “Problem: Determining Optimal Parameters of the Saw in Cotton Ginning” // Engineering and Agriculture, Moscow, 2021, No. 3, pp. 41–46.
7. Tursunov I.S., Muminov A.K. “Optimization of Ginning Process Based on Saw Geometry” // European Journal of Engineering Research and Science, 2022, Vol. 7(5), pp. 435–439.
8. Resolution No. 144 of the Cabinet of Ministers of the Republic of Uzbekistan (2020) – "Standards and Technological Requirements for Initial Cotton Processing".